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ABSTRACT

One of the critical components in the curriculum is evaluation of students' knowledge or the amount they learned in the course. Over time, the assessment process has not changed significantly; it is only recently that university instructors are turning to technology for assistance in this labor-intensive task. There are disadvantages and advantages for both instructors and students of online testing. Much of the discussion surrounding alternative testing implementation centers on various learning styles. One question is: Why do we continue to assess students in traditions set long ago? Some other questions are raised: Does the online testing improve student learning and achievement? Can/should instructors tailor tests to student's preferences for learning? How does the creation of online exams affect the instructor's workload? This research looks at two traditional face-to-face Information Systems courses which incorporated online testing into their curriculum and begins to provide some answers to these questions. (Contains 18 references.) (Author)

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INCORPORATING ON-LINE TESTING INTO FACE-TO-FACE TRADITIONAL INFORMATION SYSTEMS COURSES

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ABSTRACT

One of the critical components in the curriculum is evaluation of the student's knowledge or the amount they learned in the course. Over time, the assessment process has not changed significantly; it is only recently that university instructors are turning to technology for assistance in this labor-intensive task. There are disadvantages and advantages for both instructors and students of on-line testing. Much of the discussion surrounding alternative testing implementation centers on various learning styles. One question is "why do we continue to assess students in traditions set long ago?" Some other questions are raised: Does the on-line testing improve student learning and achievement? Can/should instructors tailor tests to student's preferences for learning? How does the creation of on-line exams affect the instructor's work-load? This research looks at two traditional face-to-face Information Systems Courses which incorporated on-line testing into their curriculum and begins to provide some answers to these questions.

INTRODUCTION

"On-line education can be defined as teaching and learning activities enabled by electronic media" (Romm and Taylor, 2000). Electronic media or "technology is not simply an add-on service as computers or audiovisual..." (Tsichritzis 1999, 93). Emerging technologies are an integral part of the university curriculum—not only are they, themselves, studied, but also the manner they support the delivery of many facets of the curriculum. One of the critical components in the curriculum is evaluation of the student's knowledge or the amount they learned in the course. Over time, the assessment process has not changed significantly (Natal, 1998); it is only recently that university instructors are turning to technology for assistance in this labor-intensive task.

There is a growing emphasis on accountability of faculty and an increased importance on ensuring student success, where success is being defined as student learning. AACSB reviewers are evaluating business curriculum with a strong interest in outcomes assessment—measures of student learning. The questions being asked are- are the students learning what the university thinks they are learning and can it be measured? How is improvement in student learning measured? Is the testing environment secure? The answers to these questions are being confounded by the proliferation of distance education or on-line courses using the Internet as a means of delivery.

For a course that is taught fully on-line or distance, it is expected that the testing component is also accomplished at a distance or on-line. However, on-line testing or assessment may be an appropriate venue for courses taught in a face-to-face environment. It may relieve part of the repetitious, time-consuming activities involved with creating exams, grading exams, and calculating the exam scores and final grades. More time

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might be spent in the actual teaching of the course content and less on administering exams. This research looks at incorporating on-line testing into a traditional lecture-based course.

BACKGROUND

Most of the on-line testing literature involves training or use of computer-based instruction (CBI)/computer-based training (CBT) (Woit and Mason, 2000; Tunc and Armstead (2001); Kaczmarczyk 2001) and the usage is either in the corporate workplace or the elementary/high school skills-based context. Recently, with the new emphasis on technology, increased band-width and the dominance of the Internet, university professors are incorporating some of this technology into their courses. On-line testing is easy to track and document (Roberts 2000; Tunc and Armstead 2001; Woit and Mason 2000) and can be used to establish baselines for future assessment. Feedback mechanisms can be incorporated into the on-line testing (Gibson, Tesone, Blackwell 2001) and different learning styles of the students can be accommodated. Therefore, this mode and process of testing or assessment may be more effective and efficient for both faculty and students.

Dottie Natal (1998, 7-9) of Imagen Multimedia Corporation presented the advantages and disadvantages for both instructors and students of on-line testing at the Technology Education Conference in Santa Clara. Advantages or benefits for students are:

- "Any time, any place" testing
- Support for ESL (English is a second language) students
- Support for students with disabilities
- Valuable class time not used for exams
- Depending upon the type of exam—immediate feedback may be available
- Access to tools they are comfortable with

Drawbacks for student include:

- Procrastination - last minute test taking
- Availability of computers
- Lack of computer skills
- Inability to use their standard test-taking skills (answering the hardest first, sure answers first....)

Some benefits for the instructor are:

- Decreased record-keeping time
- Reusable test questions
- Easier reading than hand-written
- Increased teaching time
- Better test design—for different learners
- More frequent assessments
- Better statistical feedback

Drawbacks for instructors are:

- Security problems
- Unexpected results with regard to writing standards
- Debugging problems with feedback or test administration
- Hardware problems

Other research has provided additional instructor enhancements to include immediate assessment, therefore, enabling the instructor to review areas particularly challenging for individual students based upon on-line testing scores. This in turn provides class time for discussion of more difficult topics, instead of administering quizzes and exams (Woit and Mason 2000; Tunc and Armstead 2001; Kaczmarczyk 2001).

On-line testing has been identified with distance education courses. These are courses in which students enrolled do not attend class, do not accomplish the related tasks within a set time frame and can be at any location. Many of these students have computers at home, or have access at the workplace and have mastered the software. Why not use this mode of assessment for students enrolled in traditional face-to-face university courses?

Universities provide access to computer labs throughout campus and in the domitories. Some universities require computer ownership for admission. Universities are providing wireless connections to email and the Internet enabling laptops to be used anywhere on campus. In one scenario, on-line testing might be administered in a controlled setting, with-in one of the computer labs.

One university experimented with installing a fully-outfitted computer lab for quiz taking. A proctor was hired to monitor testing activities. Students reserved a computer for completing the required quiz (Tunc and Armstead 2001). However, there is always the danger of the system being unable to accommodate users accessing the system at exactly the same time; each system has its own saturation point which must be taken into account.

Another scenario might have all students taking the test at the same time, but from any location they choose. This strategy not only raises overloading-the-system issue, but also monitoring the students while they are taking the test. Are they using books, documents, the Internet? Does the instructor care as long as the student is learning while they are completing the exam? Who is really taking the test? Will the technology create new methods of cheating?

A third scenario is any time, any place, without restraints. This probably eliminates the system-overload issue, but not the other issues. Which delivery mode is optimal depends upon the preferences of the faculty and students and the university's level of technology and support for that technology.

LEARNING STYLES

Much of the discussion surrounding alternative testing implementation centers around recent readings of various learning styles and their impact on testing and test results. Considerable research exists in tacit and explicit learning that will not be repeated here. Nevertheless, profound research conducted by Howard Gardner, author of *Frames of Mind* (1983), which led to further research, and issuing of *Multiple Intelligences* (1993) identified educators' oversight of various forms of intelligence that exists.

Dr. Gardner's work identifies more than one form of intelligence. Referred to as multiple intelligences, seven varieties of intelligence are identified by Dr. Gardner and his team of researchers. During the more than thirty years of work, psychologists working with all levels of education found that intelligence manifests itself in intrapersonal, interpersonal, spatial, linguistic, logical-mathematical, bodily-kinesthetic, and musical intelligence. It is stated that all individuals may possess more than one of the intelligences, and some, typically those who are mentally challenged, posses possibly just one of the identified intelligences. These multiple intelligences provide for a variety of perspectives on how information is learned. However, educators may fail to test more than one of these intelligences.

Currently, assessment of learning is conducted towards the logical-mathematical intelligence as specified in *Multiple Intelligences* (1993). This assessment style is derives from Binet-Spearman formulation of evaluation. In the Binet-Spearman model, "the individual is tested in isolation" (Gardner 1983, 52). This approach is used when a student sits at a desk during a designated time period (that may not be the original class meeting time or regular class meeting room) and regurgitates data pertinent to the course. As Gardner states "the mind is a multifaceted, multi-component instrument, which cannot in any legitimate way be captured in a single paper and pencil-style instrument" (1993, 70) and further that "members of Mensa are expert in nothing—except in taking tests of intelligence" (1993, 53). These claims appear to be supported by very successful students who may not do well on exams; they were not the best test takes.

The question that begs to be answered is 'why do we continue to assess students in traditions set long ago?' There is a greater understanding of learning styles which is not extended to the ability to adequately assess student grasp of information.

ON-LINE TESTING IMPLEMENTED

On-line testing was implemented in two different traditional fact-to-face courses. In one course, Business Data Communications, weekly quizzes forced students to read the text, become well prepared for class discussion and stay up-to-date with the course materials. In the other course, Management Information Systems Technology (MIST), an on-line test was used for the midterm with one section, while the other section took the exam in class. Students in both MIST sections were given the option for an on-line final exam or an in-class final exam.

Both instructors used an on-line, Internet-based course management system. The system is used throughout the university in many different types of courses. All the students in the Data Communications course had used the software in at least one previous course. It was new for some students in the MIST course. The software provides automatic grading of certain types of questions and automatic posting of grades. Faculty can design the exam in any format. The easiest design may be true/false and multiple choice, but essay questions are accommodated. Immediate feedback on an individual answer is not a feature of the software; after the test is completed the student receives feedback on the entire exam, the software generates a comparison page of student answers and correct answers.

The data communications course is an elective in the Information Systems field, the students are Juniors or Seniors, and all of the students have reasonable, if not

excellent computer skills and should all be familiar with the on-line course management program used for quizzes. In this course, valuable face-to-face in-class time was not spent on the weekly quizzes. The professor prepared only true/false and multiple choice questions based on the text material. The exam preparation time is equivalent to that for an on-line exam consisting of the same types of questions. The real time savings is in the auto-grading feature of the software. Exams were posted each week and the students had the entire week to complete the exam. The students had one hour to complete the exam; the software keeps track of the length of time spent on-line in the testing area. During class, following each exam, time was spent discussing/arguing about the exam questions, thereby reinforcing important concepts. Since extra points were earned if their arguments were successful, this strategy was a sure way to get students to participate in class discussions and stay current with the reading material. The students provided feedback on their experience.

- The quizzes were a good learning tool and should be expanded
- The quizzes forced me to stay current with the readings
- The quizzes formed me to focus on the materials and class—usually I do not read the book before studying for mid-terms
- I learned more because of the weekly quizzes

One student commented that because the quizzes were administered on-line there was no reason to attend class.

The MIST course is an introductory core Information Systems course and most of the students are Sophomores. Many of the students have used the on-line course management system before entering the course, some have not. However, all requirements and assignments for the course are available only on the on-line system and by the mid-term, each student should have experience with the system. The same instructor taught two sections of the MIST course; one section completed the mid-term during class time and the other section used the on-line system. The on-line students were on a limited time schedule, similar to those in the classroom. There is a built-in utility in the on-line system that releases the test materials at a certain time and then makes it unavailable after an elapsed period, however, the students were in the location of their choosing. Therefore, both sets of student had the same amount of time for completing the exam. The tests consisted of fifty multiple choice questions and nineteen short answer questions. The exam covered all materials up to the time of assessment. Both sets of students were advised to use textbooks, lecture notes, class papers and classmates in formulating their response. Surprisingly, exam results were slightly higher for the in-class test takers than for the on-line test takers (Table 1).

TABLE 1
GRADE FREQUENCIES

	In-class: N = 29	**On-line: N = 31**
Mean	97.7	95.8
Median:	98.4	96
Mode:	98.4	98
Std Dev.	1.6	2.36
Min/Max	93.6/100	88/98

There were 31 on-line test takers in one section of the undergraduate course and twenty-nine test takers in the in-class test-takers. Both sections were given the same test-taking directions. In-class test takers were asked to leave the room if they wanted to discuss the exam with classmates. Both exam periods were limited to the university requirements of 1 hour and fifty minutes.

Both sections had the option to take the exam as either in-class, on-line, or a mix. Interestingly, students in one section chose to take the exam in-class, and the second section chose the on-line presentation. In neither section had students participated in an on-line testing experience.

Data are limited to test scores. Demographic data on students was not collected in either testing environment. Nor was the amount of time taken for completion of the exam registered. While demographic and completion time data is available for the on-line students, these data were not collected for students completing the exam in-class.

Comments from students taking the on-line test were overwhelmingly positive. Only two mishaps occurred. Both were satisfied by reinitiating the exam on-line for one student and providing a paper copy for the second student. The student opting to complete the exam on-line was able to answer all questions in the remaining

allotted time period. Since the questions were answered once already, the student had no trouble retaking the exam. The second student experienced no difficulties in completing the written exam.

When final exam time arrived, both sections were again given the option to take the exam in-class, on-line, or a mix. The original in-class section opted for a mix of in-class and on-line with a majority taking the exam in-class. About one-third of students opted to complete the exam on-line. The original on-line class resoundingly opted for completing the final exam on-line. Part of this motivation may be a result of the exam scheduled on the very last exam date. This date may have interfered with summer plans. Taking the exam on-line allowed students to be at any location comfortable to the student.

DISCUSSION

On-line testing may add another level of complexity to the test-taking process. Either the instructor or the students may perceive on-line testing as another obstacle to conquer; in the students' mind it might be another deterrent to a good course grade. The level of technical skills of the instructor and their confidence in that skill are important factors in determining whether an attempt is made to incorporate any technology into the curriculum. The technical skill level and confidence of the student are also important factors.

Does the on-line testing improve student learning and achievement? There was no statistically significant difference in the means for on-line exams and in-class exams. Additionally, the means for the on-line exam were lower than the means for the in-class exam. Therefore, in this study, there is no improvement in student learning and achievement when an on-line exam was administered.

Can/should instructors tailor tests to student's preferences for learning? Can/should instructors offer several versions of the test and let the students select their preference—before they see the questions? This may give the students more control over their outcomes. This issue requires further study and research.

Another consideration of students in determining whether to take the test in-class or on-line may be the accessibility of the instructor to answer questions. In both instances, students were assured of instructor availability for questions arising during the exam. In the instance of the mixed test takers (some in-class, some on-line) the instructor carried a cell phone set to vibrate. In the instance of all on-line test takers, the instructor remained in the office during the entire testing period thereby providing access through email or telephone.

How does this affect the instructor's workload? "Faculty may wish to practice on the actual systems the students will be using" (Loeding and Wynn 1999, 181). A dry run enables the faculty to anticipate problems with the system, the software or the exam itself. Faculty administering on-line testing may have to be more flexible than those in a traditional classroom situation. Technical difficulties may negatively influence course evaluations at the end of the semester and can impact the perception of the entire course. In the two instances where the on-line exam failed, the instructor was flexible in allowing the students to retake the test in the on-line environment or to take the exam in a classroom environment. Although the task of grading may be eliminated for certain types of exams, this flexibility and additional access may increase the faculty's workload.

The concern about students copying or cheating is always present. Who is taking the exam and with whom are they taking it? The concept of cheating has long been a concern where there is no one monitoring the exam. Dr. Jerry Harvey (1988) claims that there is 'no such thing as cheating.' What Dr. Harvey referred to is the realization that learning occurs in various forms inside and outside the classroom. Dr. Harvey believes that collaboration is instrumental in the leaning process; it facilitates and enhances learning. He recognizes this need to accommodate various learning styles as an extension of future requirements in the chapter "Encouraging Future Managers to Cheat" in *The Abilene Paradox* (1988). In this chapter, Dr. Harvey acknowledges that once students graduate they will not work alone but with teams of people. He identifies areas of benefit in allowing students to work together in completing assessments as "providing a model of how work really gets done" (Harvey 1988, 124) and to do otherwise "thwarts the expression of synergy" (Harvey 1988, 125). By providing those skills for which the student is best able to provide for the success of the team, the concept of conducting on-line testing may support positive interaction and building of relationships towards conclusion of a task.

If Dr. Harvey's claims are accepted, cheating is one less item of concern. Furthermore, as documented by Kaczmarczyk (2001) cheating as a phenomena during on-line exams has not been sufficiently documented.

Therefore, instances of cheating in distance or non-monitored test taking may not be an issue. In the MIST exam scenario, the instructor encouraged both classes to use class notes, lecture slides, and each other for formulating responses to questions. The reality is probably time constraints inhibited much if any conversation.

Thunderstorms and power outages can adversely affect transmission of the test. Technical problems may make it impossible for a student to complete the exam in a timely fashion. If the exam is in a controlled computer laboratory setting, the system may not be able to handle 20 to 30 attempts to access it at the same time. If the exam is truly an "anyplace" exam, bandwidth may influence the assessment outcomes. Students must be very knowledgeable of the computer system they are choosing.

On-line testing should only be one component of the evaluation of the student (Gibson, Tesone, Blackwell 2001). Other activities used to asses learning outcomes might be assignments, participation credit, projects, papers or case studies.

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